

30. On the Nematode Parasites of a Chapman's Zebra.

By M. TURNER, B.Sc.

[Received October 8, 1919 : Read November 18, 1919.]

(Text-figures 1-6.)

In September of this year a Chapman's Zebra, which came from Africa to the Zoological Gardens, London, ten years ago, died. The post-mortem showed that its large intestine contained many Nematode parasites. A collection of them was made by Professor Leiper, and, through his kindness, I was enabled to examine the material in detail.

Altogether seven species of Nematodes were represented in the Zebra. An enumeration of them is as follows:—

- Oxyuris curvula* Rud. 1803.
- Strongylus vulgaris* (Looss, 1901).
- Strongylus edentatus* (Looss, 1901).
- Triodontophorus intermedius* Sweet, 1909.
- Æsophagodontus robustus* Giles, 1892.
- (?) *Cylichnostomum goldi* Boulenger, 1916.
- Cylichnostomum zebre*, sp. n.

The real object of these investigations was to ascertain whether any of the parasites had lived in the Zebra in Africa, and had persisted throughout the ten years in England, or whether they had only been acquired by the Zebra since its arrival in England. This point, however, was not definitely cleared up, as none of the Nematodes found can be said to have a solely English or African distribution. Thus *Oxyuris curvula*, *Strongylus vulgaris*, and *Strongylus edentatus* are found all over the world. *Triodontophorus intermedius* has been recorded from Australia and England, and *Æsophagodontus robustus* from India and England. The localities are so far apart that it would seem probable that these species are present in intervening countries. *Cylichnostomum goldi* has been recorded only once, and that so lately as 1916, when it was found in England. More records of its occurrence and their locality are necessary before it is possible to state its distribution definitely. *Cylichnostomum zebre* is an hitherto undescribed species.

The impression obtained from the above facts is that the Zebra acquired the majority, at least, of its parasites in England, though no definite proof of this is given.

OXYURIS CURVULA Rudolphi, 1803.

Two males were found in the Zebra. This discovery is interesting, as the males of this species of *Oxyuris* are rather rare. It was on account of this rarity that the male was only described and figured for the first time by Railliet, in 1895, although the

female, under the name *Trichocephalus equi*, had been described by Schrank so long before as 1788.

Ocyuris curcula has been recorded in the Horse, Ass, and Mule.

STRONGYLUS VULGARIS (Looss, 1901).

STRONGYLUS EDENTATUS (Looss, 1901).

In 1901 Looss recognised the three species of *Strongylus*, *i. e.*, *Strongylus vulgaris*, *Strongylus edentatus*, *Strongylus equinus*, which are known to occur in the Horse, Ass, and Mule. Of them the first two were represented in the Zebra.

TRIODONTOPHORUS INTERMEDIUS Sweet, 1909.

This species of *Triodontophorus* was first described in 1909 by Sweet, whose material consisted of three female specimens obtained from a Horse in Victoria. In 1916 Boulenger found *Triodontophorus intermedius* abundantly represented in Horses in Worcestershire, England.

The female of *Triodontophorus intermedius* from the Zebra measures 18.5–21.5 mm. in length, and the male 15–16 mm. These measurements are slightly larger than those given by Sweet or Boulenger. The spicule of the male is long and rather thick. It measures 3.8 mm. in length by about 0.03 mm. in breadth at its proximal end.

ESOPHAGODONTUS ROBUSTUS Giles, 1892.

Esophagodontus robustus was first discovered in Horses and Mules in India by Giles in 1892. Apparently this Nematode is rare in England, as there is only one previous record of its occurrence here. This was in 1916, when Boulenger obtained about twelve specimens from the colon of a Mare. Its numbers in the Zebra were sparse.

In the female *Esophagodontus robustus* from the Zebra the vulva is 2.8 mm. in front of the anus. This measurement differs from that of Giles, who gives "about 1 mm.," but confirms those of Boulenger, who gives 2.3–3 mm.

The anus is 0.7–0.75 mm. from the posterior end of the body in the *Esophagodontus robustus* from the Zebra.

(?) CYLICHNOSTOMUM GOLDI Boulenger, 1916.

The only previous record of this species was made in 1916 by Boulenger, who obtained it from the intestine and cæcum of several Horses in Worcestershire, England.

The material obtained from the Zebra and diagnosed as (?) *Cyllichnostomum goldi*, consists of a single female specimen. So far as could be ascertained from this female it appears to belong to the species *goldi*, although it is somewhat longer, being 8.35 mm., than the females recorded by Boulenger. In the absence of more material it is impossible to be certain of the species at present. The diagnosis of this female was rendered

more difficult by the similarity presented by the two species *Cylichnostomum goldi* and *Cylichnostomum pseudo-catinatum* Yorke & Macfie, 1919, seen in the following comparison.

Both *C. goldi* and *C. pseudo-catinatum* are described as having a small and delicate body. Boulenger gives the length of the male *C. goldi* as from 5.2-6 mm. and its maximum breadth 230μ - 280μ (average 255μ). Yorke and Macfie found that the length in ten males of *C. pseudo-catinatum* ranged from 5.2-6.6 mm., and that the maximum breadth averaged 260μ . The females of *C. goldi* were 6-6.7 mm. in length and 280μ - 300μ (average 290μ) in breadth. Ten females of *C. pseudo-catinatum* measured from 6.1-7.7 mm. in length and averaged 320μ in breadth. These measurements show that the size of the body of the worms of both species is practically identical. The slight difference between the two species present here is not greater than that between the measurements of individuals of the same species.

A neck is reported to be absent in *C. goldi*, but present in *C. pseudo-catinatum*. In the figure of the former species, however, a very slight constriction in the neck region is seen.

The mouth collar in both species is marked off from the rest of the skin by a definite constriction. In the figures given, the mouth collar, in both, is seen to be of a similar shape, being rather high and almost ellipsoidal in lateral view.

The submedian head papillæ in *C. goldi* are small and do not project beyond the middle of the external leaf crown. In *C. pseudo-catinatum* these papillæ are larger and project beyond the anterior edge of the external leaf crown. In both species the submedian head papillæ are conical and their extremities are not separated off by lateral notches.

Boulenger says that the lateral head papillæ of *C. goldi* are very inconspicuous, while Yorke and Macfie say that those of *C. pseudo-catinatum* are prominent. In the figures, however, the lateral head papillæ of both species appear very similar as regards size, in relative proportion to the rest of the head, and in shape.

Boulenger gives "about 20" as the number of elements in the external leaf crown of *C. goldi*, while Yorke and Macfie give 20 as the number of these in *C. pseudo-catinatum*. These leaves are large and pointed in both species.

The number of leaves in the internal leaf crown of *C. goldi* is given as 30-32, and Boulenger says that these leaves are shorter than those from the external corona. Yorke and Macfie only say that the internal leaf crown of *C. pseudo-catinatum* consists of numerous long narrow elements. Their figure shows these to be shorter than the leaves of the external corona. In both *C. goldi* and *C. pseudo-catinatum* the internal leaf crown arises in more than one plane. This arrangement is present in the other members of this group of Cylichnostomes, i. e., *C. catinatum* and *C. alveatum*.

The mouth capsules of both *C. goldi* and *C. pseudo-catinatum* are like those of *C. catinatum* and *C. abreutum* in being ellipsoidal in transverse section, with the longer axis dorso-ventral. The mouth capsule of *C. pseudo-catinatum* is described as having an oblique floor. This character is not mentioned in *C. goldi*. The optical section of the mouth capsule differs in the two species. In *C. goldi* the walls in ventral view converge anteriorly, while in *C. pseudo-catinatum* they converge posteriorly. The height of the mouth capsule of *C. goldi* is given as "about 20μ ." In the males of *C. pseudo-catinatum* this height varies from 22.5μ – 25μ and in the females from 24μ – 29μ , so that from these measurements the mouth capsule of *C. pseudo-catinatum* appears to be slightly larger than that of *C. goldi*. The measurement of the breadth of the mouth capsule has been undertaken in such different ways in the two species that it is not possible to compare the measurements given. From the figures it appears that the proportion of the breadth of the mouth capsule to its height is greater in *C. pseudo-catinatum* than in *C. goldi*.

The dorsal œsophageal gutter does not project into the mouth capsule in either species.

The œsophageal funnel is well developed in both *C. goldi* and *C. pseudo-catinatum*. In the latter, however, cuticular thickenings lining this funnel are not figured.

The œsophagus in eight males of *C. pseudo-catinatum* varies in length from 314μ – 349μ and in breadth from 70μ – 82μ . In eight females the œsophagus varies in length from 322μ – 363μ and in breadth from 72μ – 83μ . Taking the outside of these measurements the œsophagus of *C. pseudo-catinatum* varies from 314μ – 363μ in length and from 70μ – 83μ in breadth, and these measurements are not very different from the 300μ – 350μ in length and the 70μ – 75μ in breadth that Boulenger gives for the œsophagus of *C. goldi*. In the œsophagus of both species the posterior bulb is not markedly swollen.

The cervical papillæ of *C. goldi* are situated about 270μ – 300μ from the anterior end of the body. In *C. pseudo-catinatum* the cervical papillæ are at about the same level as the excretory vesicle, that is from 67μ – 152μ from the posterior end of the œsophagus. It is not possible to compare these two sets of measurements. In the figure of *C. goldi* that part of the œsophagus behind the excretory vesicle is about one-fourth of the length of the whole œsophagus, while in the figure of *C. pseudo-catinatum* the proportion of the same two parts is one-third. It may be that this figure of *C. pseudo-catinatum* is that of a specimen where the excretory vesicle is about 152μ from the posterior end of the œsophagus. In the figures the cervical papillæ of *C. goldi* are slightly more posterior in relation to the excretory vesicle than those of *C. pseudo-catinatum*.

Female. In both *C. goldi* and *C. pseudo-catinatum* the posterior region of the female is bent dorsally to make almost a right angle with the axis of the rest of the body. In both, the tail behind

the anus is narrowed suddenly to form a point. The figures show that the relative proportion of the ovi-projector to the vagina is about the same in both species. The ventral prominence and other curves in this region of *C. goldi* appear less than those of *C. pseudo-catinatum*.

Boulenger gives the distance between the anus and vulva of *C. goldi* as about 90μ - 100μ , and for the same in *C. pseudo-catinatum* Yorke and Macfie give 45μ - 85μ . Thus the anus and vulva are almost the same distance apart in, at least, some members of the two species.

Male. The two descriptions of the posterior regions of the males of *C. goldi* and *C. pseudo-catinatum* are identical in many important points.

The median dorsal lobe of the bursa is short and almost semi-circular in both species. In both, the dermal collar is well developed on the anterior and posterior (ventral and dorsal, Yorke & Macfie) surfaces. The pre-bursal papillæ are well developed in both.

The genital cone of both species is similar in having its appendages in the form of very thin delicate plates (slight elevations, Yorke & Macfie) each provided with two slender finger-shaped processes. Of these two processes the inner one is the larger in both species. The figure of the genital cone of *C. goldi* is indeed very similar to that of *C. pseudo-catinatum*.

In *C. pseudo-catinatum* the main trunk of the posterior ray of the bursa and its second lateral branch are each provided with a small accessory branch. Boulenger makes no mention of any accessory branches in his description of *C. goldi*, but his figure of a lateral view of the bursa shows an indication of one on the second lateral branch of the posterior ray, though nothing is seen on the main posterior ray. In the lateral view of the bursa of *C. pseudo-catinatum* the accessory branch of the main posterior ray is not shown.

Boulenger makes no mention of the spicules of *C. goldi*, so it is not known whether they resemble or differ from those of *C. pseudo-catinatum* which are figured by Yorke and Macfie.

This comparison of the two species, made only from descriptions and figures, was made more difficult by the different methods of treatment employed by the different writers. Nevertheless enough has been shown to prove that there are some features of very great similarity, if not of identity, in *C. goldi* and *C. pseudo-catinatum*.

CYLICHNOSTOMUM ZEBRÆ, sp. n.

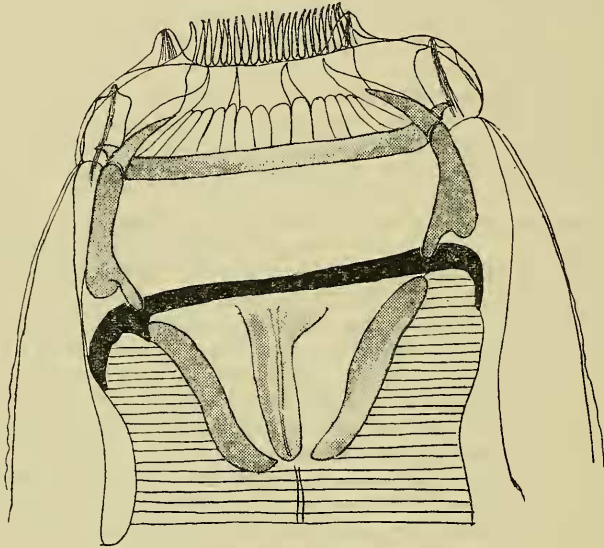
Specific diagnosis :—

Cylichnostomum zebrae is one of the largest of the Cylichnostomes, being slightly larger than *C. elongatum*, but smaller than *C. auriculatum*, which is the largest of all members of the family. The male of *C. zebrae* measures 13-13.5 mm. in length and has a

maximum thickness of 0.75 mm. The female is 17–20.5 mm. in length with a maximum thickness of 1 mm. Two males and ten females were measured. The body is thickest in the middle, but is quite thick throughout most of its length. About 3 mm. from each end it tapers to the extremities.

The wall of the intestine, especially the anterior end, is dark with a brownish pigment.

Text-figure 1.



Cylichnostomum zebrae, sp. n.

Anterior end of body. View from dorsal side.

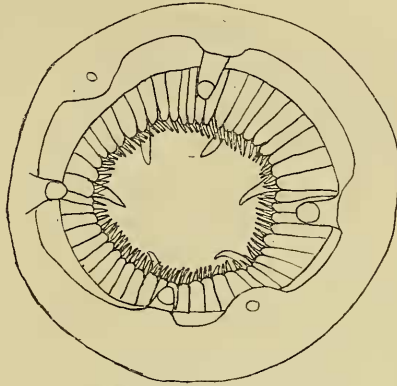
The cuticle is finely striated, the striations on the middle of the body being 15μ apart.

The head is marked off from the body by a very slight constriction. It has a diameter of 280μ – 300μ in the five specimens measured. The mouth collar is well developed, with a height of $\frac{1}{3}$ the breadth. It is almost ellipsoidal in shape, being flattened anteriorly. The lateral head papillae are broad and do not project beyond the mouth collar. The submedian head papillae are rather large and conical and project almost to the anterior edge of the external leaf crown.

The external leaf crown consists of 85–93 narrow and pointed leaves, which project well in front of the anterior margin of the mouth collar. The internal leaf crown has 48–59 leaves. Each leaf is rather blunt and is about twice as broad as one from the external leaf crown. Amongst the ordinary cuticular leaves of

this internal corona are six longer sharply-pointed ones. They are also more refractive.

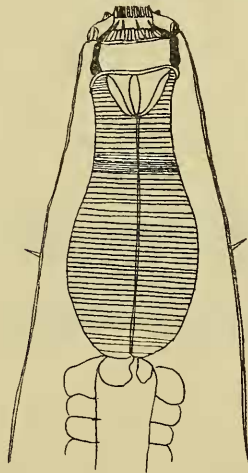
Text-figure 2.



Cylichnostomum zebrae, sp. n.

Anterior end of body. View from above.

Text-figure 3.



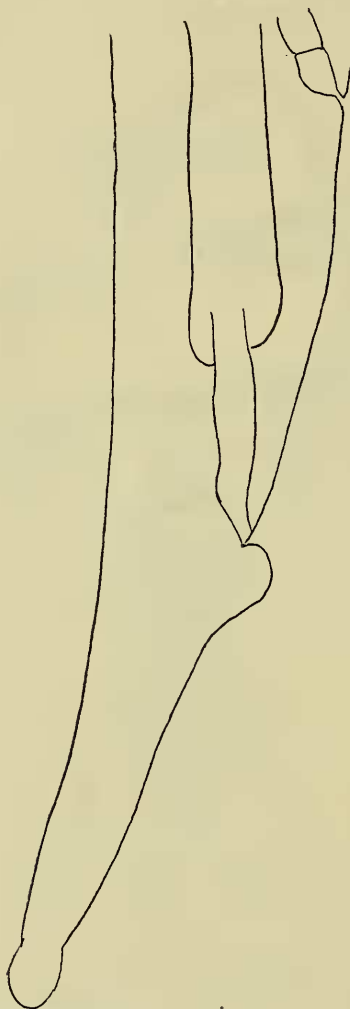
Cylichnostomum zebrae, sp. n.

Anterior end of body. View from dorsal side.

The condition of the leaf crowns in *C. zebrae* recalls that in *C. bicornatum* and *C. euproctus*, for in these three the internal leaf crown consists of fewer leaves than the external crown. In other *Cylichnostomes* the reverse of this is the case.

The mouth capsule has a height (from the anterior end of the oesophagus to the base of the leaves of the internal corona) of 85μ - 90μ and a breadth of 210μ - 250μ . In optical section its

Text-figure 4.



Cylichnostomum zebrae, sp. n.

Posterior end of Female. Lateral view.

walls seem to be composed of two parts jointed together. The anterior part is pointed and curved inwards, bearing on its

posterior outer side a short spur. The posterior part of the mouth capsule wall is thick and becomes broader towards the base, which is notched to form two parts, one narrow and the other broad and rounded.

There is no dorsal gutter.

The œsophagus is 675μ – 800μ in length and 300μ – 350μ wide at its broadest part. It is flask-shaped, with the nerve ring at the base of the neck portion. The œsophageal funnel is well developed. The anterior end of the œsophagus is covered with a cap of cuticle, which forms the floor of the mouth capsules and is oblique from side to side.

The cervical papillæ are 660μ – 700μ from the anterior end of the body and are situated halfway between the nerve ring and the posterior end of the œsophagus.

The excretory pore is slightly in front of the cervical papillæ.

Female. The posterior region is usually in a straight line with the rest of the body, but may be bent slightly dorsally. It tapers to the tip, which is rounded and rather knob-like.

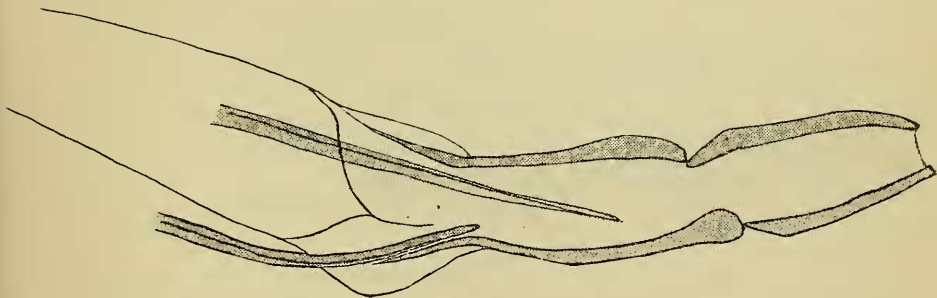
The vulva is 1.6–2 mm. from the posterior extremity and 0.9–1 mm. in front of the anus.

The vagina is about 0.6 mm. in length.

The eggs are 70μ – 80μ long by 50μ – 55μ broad.

Male. The genital cone is small. More detailed examination of it was not possible, as it was somewhat damaged in both males.

Text-figure 5.



Cylichnostomum zebra, sp. n.

Accessory piece of Male.

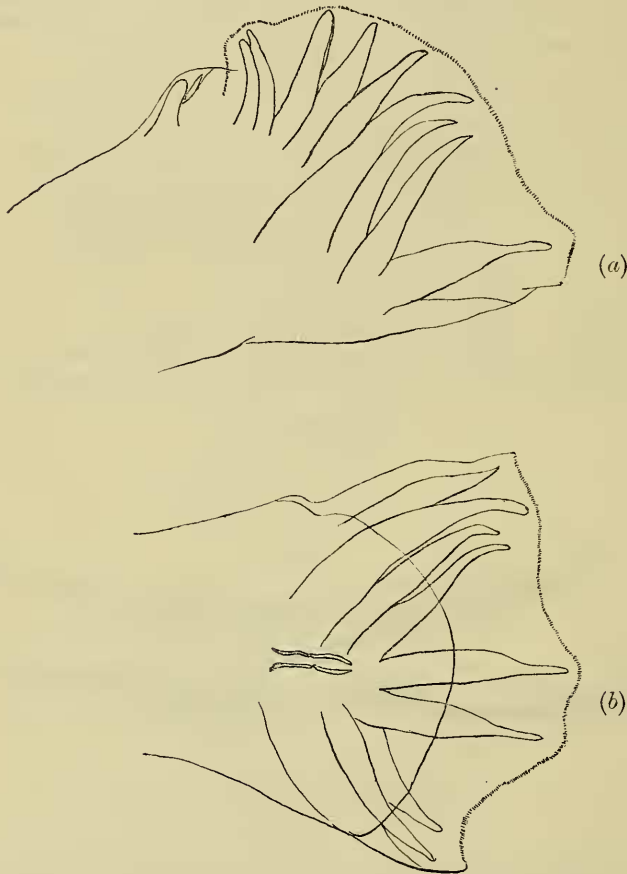
An accessory piece is present. It is saddle-shaped with inturned lateral margins. Its proximal end is bifid, each part ending in a point. The spicules are thick and about 0.95 mm. in length. Their distal ends seem to be simple points.

One of the most striking characters of the male is the finely serrate edge of the free margin of the bursa. This is a character only described in *C. poculatum* amongst the *Cylichnostomes*.

The pre-bursal ray is short and the dermal collar small.

The median lobe of the bursa is very short and notched. The dorsal ray, which narrows abruptly to form a finger-like distal extremity, with its two branches arising together and equal in length, differs from the dorsal ray of the bursa of any Cylichnostome hitherto described. So that the dorsal ray forms one of the chief distinguishing features of *Cylichnostomum zebrae*.

Text-figure 6.

*Cylichnostomum zebrae*, sp. n.

Bursa of Male. (a) Lateral view. (b) Dorsal view.

Another character peculiar to *C. zebrae* is the possession of the six elongated and highly refractive leaves interspersed between

the ordinary leaves of the internal leaf crown. These specialised leaves have not been recorded in a *Cylichnostome* before.

In passing the final proofs of the above paper for press on January 27th, 1920, I note that the Nematode described therein as *Cylichnostomum zebra* n. sp. has been named *Hexodontostomum markusi* n. gen. n. sp. by Ihle in *Cent. f. Bakt., Abt. i.*, Orig. Bd. 84, 1920, Heft 1.

References.

- BOULENGER, C. L. (1916). "Sclerostome Parasites of the Horse in England. 1. The Genera *Triodontophorus* and *Æsophagodontus*." *Parasitology*, viii. (4).
- (1917). "Sclerostome Parasites of the Horse in England. 2. New Species of the Genus *Cylichnostomum*." *Parasitology*, ix. (2).
- GILES, G. M. (1892). "On a New Sclerostome from the Large Intestine of Mules." *Sci. Mem. of the Medical Officers of the Army of India*, part 7, article 2.
- LOOSS, A. (1901). "The Sclerostomidæ of Horses and Donkeys in Egypt." *Rec. Egypt. Govt. School of Med.* i. pp. 25-139.
- RAILLIET, A. (1895). *Traité de Zoologie Médicale et Agricole*, p. 415.
- *SCHRANK, F. v. P. (1788). "Verzeichniss der bisher hinlänglich bekannten Eingeweidewurmer, etc." *Kgl. Svenska Vetensk. Akad. Stockholm*.
- SWEET, G. (1909). "The Endoparasites of Australian Stock and Native Fauna Part 2. New and Unrecorded Species." *Proc. R. Soc. Vict.* xxi. p. 454.
- YORKE, W., & MACFIE, J. W. S. (1919). "Strongylidæ in Horses. vi. *Cylicostomum pseudo-catinatum*, sp. n." *Annals of Trop. Med. and Parasitology*, vol. xii. Nos. 3 & 4, February, 1919.

* Not seen.